NEWSLETTER

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AUSTRALIAN SOCIETY FOR LIMNOLOGY

The Australian Society for Limnology is an association of over 400 people with professional or amateur interests related to Australian inland waters. Since its inception in 1961 the Society has played an important role in fostering limnological work in this country. The ASL promotes liaison between limnologists in academic, private and governmental institutions and has a vested interest in the conservation of aquatic and related resources. Annual congresses are held near centres of limnological interest, and the programme includes scientific sessions, field excursions and social activities.

The ASL produces a *Newsletter* with notes on activities, articles of general interest, book reviews and congress announcements; a *Bulletin* of original scientific papers and occasional *Special Publications*. A further publication is the *Directory of Australian Limnologists*.

Membership applications are welcomed; four classes of subscribing membership are available:

Ordinary members	$10.00 p.a.
Student members	$4.00 p.a.
Institutional members	$10.00 p.a.
Sustaining members	Fees on application

Members are entitled to receive the Australian Journal of Marine and Freshwater Research at the reduced rate of $12.50 p.a.

Membership subscriptions cover the period 1 July to 30 June but subscriptions for Aust J. mar. Freshwat Res. cover the period 1 January to 31 December.

Enquiries relating to membership should be addressed to:

Ian Campbell,
Secretary, ASL.,
c/- Department of Chemistry,
Caulfield Institute of Technology,
P.O. Box 197,
Caulfield East, Victoria,
Australia 3145.

ASL Executive 1980-81

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Robert White

Newsletter Editor:

R.W.G.White,
Department of Zoology,
University of Tasmania,
Box 252C, G.P.O.,
Hobart, Tasmania,
Australia 7001.

EDITORIAL

The new-style smaller format Newsletter seems to have met with the approval of members. I received twelve positive comments and no negative ones. Admittedly this is a small "sample" of a "population" of over 350 members. I feel sure, however, that anyone who really hated the A-5 lay-out would have let me know or even resigned from the Society in protest! Ian Campbell hasn't, I understand, been deluged with letters of resignation so I shall continue with the new format.

In the previous issue I indicated that I would only produce two issues of this volume in order to bring the 'Newsletter year' in line with the calendar year. Thereonafter, I would revert to the usual three issues per volume. I have since discovered that for a publication to be considered eligible for 'Category B' status by Australia Post it must be published at least four times a year. The saving on postage for a Category B publication is considerable: the last issue of the Newsletter cost 12¢ per copy to mail; normal postage would have been 40¢. After calculating the relative costs of producing three issues a year and paying full postal rates, or four slightly smaller issues and gaining the benefit of the cheaper mailing charges I have decided to opt for the latter as it represents a saving to the Society of over $150 a year. So, from Volume 19 onwards, you should receive four issues a year. I am aiming to publish in March, June, September and December.

The exact publication dates will depend on a supply of items from members (again sadly short in this issue) and after pressures on my time and that of the University of Tasmania's Printing Section. As might be expected, the A.S.L. Newsletter warrants a relatively low priority.

In the first issue next year I hope to introduce a feature profiling Australian Institutions which are carrying out studies in limnology. For the present issue, little new or exciting! Putting the Newsletter together is a

difficult task which could be made much easier by members putting pen to paper and letting me have that news, requests, moans, etc. Remember, I did say I would open a 'Letters' section - all I need are the letters!

Finally, if you haven't done so already please pay your subscriptions promptly. And do have a very rewarding New Year.

Robert White

NEWS & VIEWS

Have you paid your ASL subscription?

The request for your 1980/81 ASL subscription accompanied the last issue of the Newsletter. If you haven't done so yet please send off your cheque promptly. The Secretary and Treasurer have enough to do without having to send out reminder letters.

1981 ASL Conference

As announced in the last issue of the Newsletter the 1981 Annual Conference will be held at Narooma, N.S.W. from 22-25 May 1981. The Conference will be housed in the Narooma High School, a new building with good facilities. Ample accommodation will be available in motels, hotels and camping site. Full information will be given in the next Newsletter.

International Symposium on Coastal Lagoons (ISCOL)

This symposium, which is being sponsored by UNESCO, will be held in Bordeaux, France, on 8-14 September 1981. The objectives of the symposium are stated as:

> "To review our knowledge of these most important coastal systems.
> To promote contacts among specialists in different areas of research.
> To stimulate the development of interdisciplinary regional projects".

Further details from:

> Dr. Pierre Lasserre, Secretary General
> ISCOL/UNESCO 81
> Institut de Biologie Marine
> Université de Bordeaux I
> 33120 Arcachon, France.

Wanted Alive - Mussels

Keith Walker (Zoology Department, University of Adelaide) would be grateful to hear from ASL members who may be able to supply live specimens of freshwater mussels (Hyriidae) from areas other than the Murray-Darling river system. Any postage costs would be paid. The mussels, hopefully containing glochidia (larvae), would contribute to a study of the significance of larval forms in the taxonomy of the regional fauna (Australia, New Guinea and New Zealand). A number of species have been investigated so far, and it appears that the glochidia are quite distinctive at the levels of subfamily and genus. This

study has developed in association with a recently completed AWRC project concerning the ecology of freshwater mussels in the River Murray.

Keith's address is Zoology Department, University of Adelaide, G.P.O. Box 498, Adelaide, South Australia, 5001.

New "Fauna of Tasmania" Handbook

The "Fauna of Tasmania" Committee recently published a new handbook, "Tasmania Echinoderms" by Alan Dartnall. The handbook includes a general account of the zoogeography of Tasmanian echinoderms, notes on collecting and preservation, a full checklist of Tasmanian species, fully illustrated keys to all species and distribution maps. It has 84 pages and costs $3.75 including postage. Orders (with cheques etc. payable to "University of Tasmania") to:

Fauna of Tasmania Office,
University of Tasmania,
Box 252C, G.P.O.,
Hobart, Tasmania,
Australia, 7001.

Annual Scientific Meeting of the Australian Society for Microbiology

This meeting will be held in Canberra on 4-8 May 1981. Details are available from V.A. Stanisich, Australian Society for Microbiology, 191 Royal Parade, Victoria 3052.

4th International Symposium on Trace Element in Man and Animals (TEMA-4)

TEMA-4 will be held in Perth on 11-15 May 1981. It is sponsored by the Australian Academy of Science and the Nutrition Society of Australia. Information can be obtained from Dr. E.J. Underwood, Chairman, Organising Committee, TEMA-4, C/- Department of Animal Science, University of W.A., Nedlands, W.A. 6009.

Sixth Australian Symposium on Analytical Chemistry (6AC)

The Royal Australian Chemical Institute is organising 6AC in Canberra. The Symposium will be held on 23-28 August 1981. Further information from Hon. Secretary (6AC), P.O. Box 1397, Canberra City, A.C.T. 2601.

Hydrology Symposium

The Institution of Engineers, Australia will be holding a symposium on hydrology in September 1981 in Melbourne. Details from the Institution of Engineers, Australia, 11 National Circuit, Barton, A.C.T. 2600.

AWRC Research Program - Fifth Triennium

The approved program of research was recently announced by the AWRC. Thirty-one projects were sponsored. These include:

Field portable instruments for analysis of heavy metals in water - Dr. A.W. Mann, CSIRO Division of Mineralogy.

Management of water quality in multiple use reservoirs - Prof. J. Imberger, University of W.A.
Pescitide inputs to streams in agricultural catchments - P.D. Sutherland, E.P.A., Victoria.
Microbiology water quality criteria - Ms A. McNeill, State Rivers and Water Supply Commission, Victoria.
Ecology of the yabby and assessment of its potential as a heavy metal indicator - Dr. P.S. Lake, Monash University.
Investigation of the relationship between trace metal speciation and toxicity to selected freshwater biota - Dr. B.T. Hart and Mr. I. Campbell, Caulfield Institute of Technology.

A full list of approved projects was published in Water Resources Newsletter No.55, August 1980.

BULLETIN

The Bulletin of the Australian Society for Limnology No. 7 was published earlier this year. This was the first issue to be published for some years. The future viability of the Bulletin depends on it being published regularly with good quality papers; and this, therefore, depends on the membership. If the Society wishes to have the Bulletin members must be prepared to submit papers which they might otherwise send to other journals.

The next issue of the Bulletin will be edited by Robert White with assistance from Peter Tyler and Alastair Richardson. Manuscripts should be sent to Robert White at the address given on page 2 of this Newsletter. All papers will be refereed.

The Editor of the Newsletter will be willing to publish correspondence from members on the role of the Bulletin.

The Secretary still has a good stock of earlier issues of the Bulletin. They may be purchased from him at a cost of $1.00 per copy plus postage. Cheques should be made payable to the Australian Society for Limnology.

BOOK REVIEWS

PROCEEDINGS OF A SYMPOSIUM ON BIOLOGY AND MICROBIOLOGY OF WATER HELD IN CANBERRA, 25-26 AUGUST, 1977. Edited by J. Powling, P.S. Lake and A. Gilmour (1979). 169 pp. Australian Water Resources Council, Department of National Development. Soft cover $10.40 (Available from Australian Government Publishing Service's Bookshops).

Reviewed by D.P. Thomas.

It is a sad reflection upon the present state of funding for aquatic science generally that time spent in participating in Symposia and Workshops seems to be inversely proportional to the availability of research finance. And many of these symposia appear to be exercises in enabling the same people to regurgitate the same tired old lectures to people who have already heard them before.

Reading the proceedings of this symposium came as a refreshing change in that they bring together papers on sampling strategies and techniques, and the problems encountered therein, clearly set out by people with considerable practical experience in each field. In addition, recommendations from the workshop discussions are appended. The papers are grouped into three sections (1: Bacteria and Viruses; 2: Algae; 3: Fauna) and vary from discussions of sampling techniques for viruses (by Felicity Smith) and benthic invertebrates (by Ian Campbell) to the general effects of pollutants on aquatic systems (by Sam Lake) and the problems involved in using organisms as indicators of water quality.

Each paper has been rendered readable by being resolved into a series of notes where practicable and clearly titled sections for the rest. As such,

the subject matter is made readily available to student, novice and besieged researcher alike.

To summarise, the papers tend to bear out Ian Smalls' statement that, "the sample is the most important part of the chain from site to data". As such, it requires very careful appraisal of the techniques to be used for its collection and enumeration, and the presence of experienced and competent personnel overseeing and participating in the process.

For my part, the highlight from a theoretical point of view is Sam Lake's paper, "Pollution as a stressor of aquatic ecosystems", (pp. 93-104). Written in a style which is at once easy to read and scientifically precise, this paper covers a range of conceptual frames of reference into which pollution effects can be placed and based upon their effects upon certain properties of the ecosystem (e.g. system metabolism, species richness, etc.).

From the more practical side of studying aquatic systems three papers come to mind, one from each section. Deborah Walker's paper,"The problems of an indicator system for potential pathogens in water", served to renew my respect for microbiologists and the difficult tasks which face them in monitoring our waters. This paper covers not only the problems associated with isolating and monitoring pathogenic microbes but also the problems faced in trying to find their source.

Bruce Chessman's paper, on the other hand, is, as far as I know, the first report of the use of the "Diatometer" in Australia. Perhaps one of the advantages of Australia's glorious isolation is that we are less prepared to take imported techniques at face value. In this case the diatometer has been used for nearly twenty-five years in North America and to a lesser extent in Europe. In spite of this, Bruce brings up some valid criticisms of the technique which have not been previously recorded.

Finally, Robert White's paper, "Problems of sampling and identifying Zooplankton", covers sampling and identification strategies and inadequacies which are echoed in the other fauna papers.

Clearly the message seems to be that the smaller the organisms, the more useful they may be for monitoring but the more difficult they may be to put to that use due to problems of sampling and identification.

HYPERSALINE BRINES AND EVAPORITIC ENVIRONMENTS

Edited by A. Nissenbaum (1980). 270pp. Elsevier Amsterdam.

Reviewed by I.A.E. Bayly.

On the basis of the publishers' publicity slip which inter alia noted that "evaporitic environments pose many pertinent problems in such disciplines as ecology ...", I picked up an aerogramme and sent off my order to Heffers of Cambridge. The book arrived reasonably promptly. So too did a bill for $49.99. Allowing $4.76 for postage, etc., and also for the fact that the book contained nine totally blank pages, a quick calculation showed that I had paid 17.3 cents per printed page. It had better be good, I thought. Unhappily it wasn't, at least not for someone who is fundamentally a biologist.

I suppose it is by definition parochial to look at a book from the viewpoint of the extent to which it refers to one's own country, but, bearing in mind the above title (no regional limitation), and the following facts, I believe that a degree of parochialism is justifiable. Australia accounts for about five per cent of all land areas of the world and most of it is covered by endorheic and arheic drainage systems. The Lake Eyre drainage basin with an area in excess of 1.3×10^6 km^2 is probably the largest endorheic system in the world. Not only is the area of salt lakes in Australia great, but neither has the study of them been neglected during the past 10-15 years. Thus in Williams 1978 review which is restricted to Victorian salt lakes, some 48 Australian papers published (I have excluded unpublished theses) since 1964 are cited. Many more were published on Australian salt lakes outside Victoria during the same period. Turning to the book, I am able to state that although it contains 450 references in toto only one of these is to Australian biological work (see Borowitzka and Brown (1974) on p.38). Other Australian work to score a mention is that of Childs et al. and Whitfield on chemical aspects (pp.81-83), and of Alderman and Skinner on South Australian dolomites (pp.250-251).

The book contains 17 chapters only two of which are exclusively devoted to biological aspects. Ten chapters are essentially on chemical or geochemical aspects. One of the latter (Chapt. 6, "Salt effect on the pH of hypersaline solutions") seems an excellent concise account and is accompanied by a wealth of references. Isotope hydrology and the hydrology of the Caspian

Sea and the Great Salt Lake are also discussed.

I turned to Larsen's chapter entitled "Ecology of hypersaline environments" (note the lack of any biotic or regional restriction in the title) hoping to find a good and refreshingly new review of the topic. I was sorely disappointed. In fact had I not already known otherwise, I would have left this chapter believing that bacteria, a few protozoa, Dunaliella and Artemia salina are the only organisms that have been recorded from hypersaline habitats.

Parartemia and Haloniscus apparently don't exist and neither do the several, if not numerous, Australian species of ostracods and copepods that have been recorded from salinities in excess of 100‰. If the latter value is not "hypersaline" then I'll eat my hat (or plankton net).

In Figure 8-1 ("Occurrence of heliothermal lakes") a large black dot is shown for Australia in the approximate position of Lake Eyre. Maddeningly, however, there is no reference in this chapter ("Heliothermal lakes") to this plot and neither is any Australian work included in the references (most if not all of the other plots do seem to be accounted for and referred to in the text). One is left with the impression that the said dot was included because Australia looked large enough to have a heliothermal lake somewhere. (There probably is, but the meromictic lakes described by Timms and Tyler et al. seem not to be significantly heliothermal.) The references at the end of this chapter include one (p.99) to "This volume p.000". A similar reference appears on p.153.

Reverting to my aerogramme to Heffers, I also included in it an order for Lewis W.M. (1979). Zooplankton Community Analysis. Springer-Verlag, New York. I may review this later, but in the meantime intending purchasers should be warned that in this case the cost per page of text is 15.9 cents.

For the time being I've stopped buying personal copies of scientific books. I'm sure the reason won't escape you!

ABSTRACT OF THESES

The following abstracts are of theses in the freshwater field produced in the Zoology Department, University of Tasmania from 1978 to 1980. Abstracts of theses from other institutions will be published in later issues.

CIRCADIAN RHYTHMS, AND THEIR MEASUREMENT BY MICROCOMPUTER, IN GEOCHARAX GRACILIS (CLARK, 1936).

Malcolm E. Ritchie, B.Sc. Honours Thesis 1978.

Supervisor: Dr. A.M.M. Richardson.

1. Inferential methods were used to determine the life history of Geocharax gracilis. The average life span was estimated to be three to four years with both males and females probably reaching sexual maturity in their second year. Males grow to a larger overall size and possess larger chelae than females of a similar size.

2. An analog multiplexer was designed which would allow the output of nine actographs to be displayed as a single trace. This method was only suitable for short periods of behaviour recording. However with longer cycling times it is useful for monitoring temperature or water level changes.

3. Methods were developed which allowed monitoring of crayfish locomotor activity in actographs simulating both the free water and burrow environments. These actographs, which were cheap to construct and of compact size, depend on photoelectric detection of crayfish movements. Two microcomputers were used to record the individual activity of many crayfish simultaneously, and to reduce this to a convenient form.

4. The persistent circadian rhythm of Geocharax gracilis in the free water situation is described. A large individual variation in activity pattern was found, indicating that larger sample sizes than previously reported are needed to describe a population's activity.

THE ECOLOGY OF THE SANDY, PSEUDAPHRITIS URVILLII, IN SOUTH-EAST TASMANIA

Michael E. Hortle, B.Sc. Honours Thesis 1978.

Supervisor: Dr. R.W.G. White.

This study examines some of the features of the biology of the sandy, Pseudaphritis urvillii, with particular reference to the structure, dynamics

and movements of a population of sandys.

The examination of 3000 fish, and the direct ageing of over 700 of these, has provided reliable information on the age and growth of sandys.

The marking of more than 2000 fish has enabled reliable population estimates to be made, and provided information on the reproductive movements of the fish.

The study of more than 700 guts gave good data on diet, and examination of the state of maturity of the same fish has provided an insight into the breeding biology of the fish.

Consideration of the above data has enabled a tentative life cycle to be proposed for Pseudaphritis urvillii.

THE ECOLOGICAL EFFECTS OF MINE EFFLUENTS ON THE SOUTH ESK RIVER (NORTH-EAST) TASMANIA.

R.H. Norris, Ph.D. Thesis 1979.

Supervisors: Dr. P.S. Lake and Dr. R. Swain.

The ecological effects of mine effluents on the South Esk River have been investigated over two years on a 130 km section of river below the pollution source. The data was obtained from bimonthly samples at eight sites (three above the pollution inflow and five below it) and three supplementary sites. Basic water characteristics, and trace metal concentrations in the sediments, non-filterable residue (N.F.R.) and in solution as well as quantitative sampling of the benthic macroinvertebrate fauna have been measured.

Highest rainfall is normally in the winter with high surface run-off during this period and high retention in the ground during the summer. Large differences in rainfall and subsequent discharge occurred between the successive years of the study. The concentrations of total dissolved solids of the South Esk were about 100 mg/l and the water was soft. The pH was slightly acid and stable indicating a well buffered natural water. The major cations generally increased in concentration downriver; it is considered that surface run-off followed by evaporation and concentration were most likely to control cation concentrations and exert overall control of the water chemistry. Oxygen levels were near saturation and chloride, nitrate and phosphate concentrations were all low.

Mn, Fe, Cd, Zn, Cu and Pb concentrations were measured and the first two of these have been shown to be independent of the mine effluents. The natural background levels of Cd, Zn, Cu and Pb have been found to be very low or below detection limits. However, in the contaminated stretch of river the concentrations of these four metals in the sediments, N.F.R. and solution were all well above the natural background levels up to 130 km from the pollution inflow. The spatial and temporal variations in the concentrations of each trace metal in the three fractions have been examined. The concentrations of Cd, Zn, Cu and Pb in the sediments and Cd and Zn in solution show an inverse relationship with the distance from the source of contamination, whereas the concentrations of Cu and Pb in solution and all four metals associated with the N.F.R. show no significant spatial differences. Possible physical and chemical mechanisms controlling spatial and temporal variations, and the par-

titioning between the three different fractions are discussed.

The effects of the influx of trace metals are apparent from examination of the absolute numbers of animals and the numbers of species. This examination indicates no recovery as far as 80 km downriver from the inflow of trace metals. Spatial and temporal variations in the numbers of individuals and the numbers of species are discussed in relation to physical and chemical features of the river.

Several subjective and mathematical procedures have been employed to group the species collected on the basis of their distributions and abundances. The mathematical procedures included Principal Component Analaysis, a hierarchical classification and a non-hierarchical classification. The application of these methods to studies such as this one has been discussed and evaluated.

By using these grouping procedures the species collected have been separated into three groups; a) species which were relatively abundant at both contaminated and uncontaminated sites, b) species which were most abundant at sites above the polluted section and c) species whose numbers were highest at sites below the source of contamination. A leptocerid caddisfly and a baetid mayfly were the only two species which maintained high numbers at sites above and below the pollution inflow. Several species which were numerically dominant at the uncontaminated sites were almost, or completely eliminated at sites below the inflow of metals. These included two mollusc species, four species of leptophlebiid mayflies and five species of caddisflies. Generally the molluscs and crustaceans were found to be sensitive to trace metal contamination and the dipterans insensitive. However, wide differences in the reaction of even closely related species to the metal contamination have been shown to exist. The factors which are likely to be important in determining the harmful effects of trace metal contamination in the field are discussed and as an adjunct to this, the relationship between the toxic concentrations of metals reported by other workers for laboratory studies and those found to produce harmful effects in the South Esk are also discussed.

The Margalef and Shannon and Weaver diversity indices both demonstrated only the gross effects of metal contamination. Statistical correlations have been carried out between these indices and the trace metal concentrations in order to evaluate their usefulness for identifying the causes and effects of trace metal contamination. The Margalef index was found to be more efficient in this regard. However, a comparison between the information gained from the two indices and that from statistical examination of the numbers of individuals and the numbers of species, showed that these indices were of limited value for this purpose.

The composition of the drifting invertebrate fauna in contaminated and uncontaminated sites has been investigated in both summer and winter. Changes in the composition of the drifting fauna and possible reasons for these are discussed. It is suggested that the species comprising the drift may react in different ways when they enter the contaminated zone and that this may result in faunal changes in the section of a river immediately upstream from the source of contamination.

Finally, general criteria for the assessment of trace metal contamination of rivers have been discussed and factors which may be generally applicable to the study of pollution in rivers are presented.

ELECTROPHORETIC, MORPHOMETRIC AND KARYOLOGICAL STUDIES ON THE GENUS GALAXIAS (GALAXIIDAE) IN TASMANIA.

Craig R. Johnson, B.Sc. Honours Thesis 1979.

Supervisor: Dr. R.W.G. White.

1. A review of the literature on lacate dehydrogenase (LDH) in fishes is given.

2. The electrophoretic pattern of LDH in white skeletal muscle, heart muscle and pooled red and white muscle from Galaxias auratus is described.

3. It is suggested that the genetic control of LDH in G. auratus involves the activity of three genetic loci which code for three different subunits, A, B and C. These subunits assemble in various combinations of four to produce a series of tetrameric LDH isozymes.

4. Two theories are offered for the relative electrophoretic mobility of the subunits. In Theory I, the relative anodal mobility is B > C > A, and in Theory II the relative anodal mobility is C > B > A.

5. The formation of nine, instead of a theoretical fifteen, LDH isozymes is attributed to different isozymes having the same electrophoretic mobility.

6. The LDH polymorphism and tissue specific electrophoretic patterns of LDH in G. auratus is most likely due to a differential predominance of B over A, and possibly C, subunits.

7. A resumé of non-specific esterases in fishes is presented.

8. The electrophoretic pattern of esterases in white skeletal muscle of G. auratus is described. A total of sixteen esterase bands were identified and attributed to the activity of thirteen genetic loci. Four esterase loci appear to b polymorphic, each possessing two codominantly expressed allelic variants. A 'null' allele is evident at one of these loci.

9. The results of a multivariate statistical analysis of morphometric parameters of the ten species of Galaxias in Tasmania and a karyological study of seven of these species are discussed in attempting to determine the phylogenetic affinities among the Tasmanian representatives of the genus.

10. Two major evolutionary lineages, the 'G. brevipinnis-like' and 'G. truttaceus-like' lines, are identified. It is suggested that G. johnstoni and G. fontanus are land-locked derivatives of a G. brevipinnis-like stock. These three species comprise the G. brevipinnis-like lineage. It is likely that G. fontanus emerged from this line prior to G. johnstoni.

G. maculatus may represent a very early divergence from the G. truttaceus-like line, and this species is now distinct from all other Tasmanian species of the genus. It appears that G. auratus, G. tanycephalus and possibly G. pedderensis have been more recently derived from a G. truttaceus-like stock by land-locking. These species comprise the remainder of the G. truttaceus-like lineage.

11. The phylogenetic positions of G. cleaveri and G. parvus are not clear. However, G. cleaveri and G. maculatus appear to exhibit morphological convergence, as do G. parvus and G. olidus.

12. Assuming a monophyletic origin of the Tasmanian representatives of

Galaxias, the karyological analysis indicates that the ancestral Galaxias was closer to the G. brevipinnis-like lineage than the G. truttaceus-like stock.

13. The emergence of the G. truttaceus-like line from the original Galaxias stock, and the early divergence of the ancestral G. maculatus from the G. truttaceus-like lineage is not likely to have occurred in Tasmania.

14. It appears that the ancestral G. brevipinnis and the ancestral G. truttaceus, but not the ancestral G. maculatus, invaded Tasmania to give rise to the endemic species of Galaxias (not considering the presently unplaced G. cleaveri and G. parvus).

15. The arrival in Tasmania of the modern-day G. maculatus, G. brevipinnis and G. truttaceus is likely to have been relatively recent.

16. It is suggested that the two endemic species found in Lake Padder, G. parvus and G. pedderensis, did not undergo speciation in this lake. It is almost certain that these two species did not speciate sympatrically.

STRUCTURE AND FUNCTION OF THE FENESTRA DORSALIS IN THE SYNCARID GENUS ALLANASPIDES.

Fiona M. McConnell, B.Sc. Honours Thesis 1979.

Supervisor: Dr. R. Swain.

1. Aspects of the sodium transport system of Allanaspides helonomus (Syncarida : Crustacea) have been investigated. The maximum sodium uptake rate and the external sodium concentration which half-saturates the system are amongst the lowest observed for Crustacea. The sodium transport system in A. helonomus apparently functions largely independently of pH. This is a specialization which greatly facilitates its habitation of an acidic fresh-water environment.

2. Water fluxes in A. helonomus have been measured using tritiated water. The permeability of water, and urine flow rate thus determined are comparable to those of other small crustaceans. These findings are discussed in relation to the measured haemolymph sodium concentration and permeability to salts, to support the results of the investigation on the sodium transport system.

3. A combination of physiological measurements and ultra-structural observations has been used to investigate the role of the fenestra dorsalis in active ion transport. Supplementary information on the possible involvement of the gills of A. helonomus in ion transport has also been obtained. Results indicate that the fenestra dorsalis contributes significantly to the uptake of sodium, and that the gills also are likely to be involved.

4. The effects of two enzyme-specific inhibitors on sodium uptake in the fenestra dorsalis have been investigated. The results are interpreted as confirming the presence of two discrete sodium transporting mechanisms in the epithelial cells. Ultrastructural evidence is used to support this conclusion.

5. The effects on the epithelial ultrastructure of the fenestra dorsalis of exposure to an elevated salinity for different lengths of time, and the applicability of Diamond and Bossert's theoretical model for fluid and electrolyte transport to the fenestra dorsalis, have been examined. A hypothesis is pro-

posed to describe the time course of the observed ultrastructural changes and to relate this to the transport function of the tissue. The modifications of ultrastructure observed after prolonged exposure to an elevated salinity are considered to be irreversible on the experimental time scale used. On the basis of quantification of the ultrastructural changes, and their correlation to sodium flux rate measurement, the possibility of a close association between structure and function in the transporting epithelium is supported.

6. Discussion on the possible significance of the results obtained with regard to the adaptation and evolution of Allanaspides helonomus is included.

OBSERVATIONS ON THE BIOLOGY AND ECOLOGY OF TWO SPECIES OF TASMANOPERLA (PLECOPTERA).

Janet H. Waterhouse, B.Sc. Honours Thesis 1979.

Supervisor: Dr. R.W.G. White.

1. A comparison of the nymphal and adult morphology of the Tasmanoperla spp. indicated that the presence of an abdominal spine in T. thalia is suitable for the taxonomic separation of nymphs and female adults; whilst body size, genitalia and wing length are suitable for separation of the adult males.

2. Scanning electron microscopy failed to reveal new characters useful for the taxonomic separation of the numphs of the two species. The presence of 'flower-bud-like' sensilla on the gills, similar to those on the Eusthenidae are described and a pattern for their development suggested.

3. Comparison of the life histories of the two species indicated life cycles of between 2 and 4 years, although there is some indication that the life cycle of T. larvalis is shorter than that of T. thalia.

4. 11 to 15 nymphal instars are indicated by the analysis of field samples and the laboratory rearing of nymphs of each species. There is some indication that the number of instars in the males of T. larvalis is less than that of the females and that polymorphism of wing length is variable between T. larvalis populations. Several different methods of instar analysis are compared.

5. The importance of temperature in adult emergence, egg diapause and nymphal development is discussed.

6. Adult emergence of T. larvalis is shown to precede that of T. thalia and is more synchronous. The emergent sex ratio was dominated by males in an observed population of T. larvalis.

7. Ecydsis, mating and oviposition in the Tasmanoperla spp. are compared with the patterns in other stoneflies.

8. T. larvalis adults showed strong diurnal activity with marked activity suppression during lighted periods. Negative phototaxis was also observed.

9. A survey of the distribution of the nymphs of two species in 5 streams draining the Mt. Wellington-Collins Bonnet Plateau revealed a strong altitudinal zonation, with T. thalia consistently occuring above T. larvalis.

10. Extensive sampling indicated zonation patterns in the associated fauna, riparian vegetation, canopy cover, temperature regimes, substrate types, water

chemistry and river gradients. Although none of these zonation patterns correlated closely with those of the Tasmanoperla, temperature and river profile appear to be of considerable importance.

11. The impact of fire frequency on riparian vegetation and canopy cover is discussed in relation to the zonation of nymphs in Hobart Rivulet.

12. The view that wing length is of primary importance in the distribution of the Tasmanoperla spp. is expressed.

13. An attempt is made to present a possible evolutionary path for the divergence of the two species and their relationship with a number of Victorian austroperlids.

MODELLING THE STAGE-SPECIFIC POPULATION DYNAMICS OF BOECKELLA SYMMETRICA SARS (COPEPODA : CALANOIDA) LABORATORY POPULATIONS.

Ian O. Woodward, B. Sc. Honours Thesis 1980.

Supervisors: Dr. A.M.M. Richardson and Dr. R.W.G. White.

1. Information on the vital statistics of isolated Boeckella symmetrica Sars individuals was obtained.

2. An existing mathematical model for population growth (Leslie 1945) was modified to allow the stage-specific dynamics of B. symmetrica populations to be predicted from the vital statistics of individual animals.

3. The population dynamics of laboratory mass cultures were compared with the predicted dynamics generated by the model.

4. B. symmetrica egg development time descreases hyperbolically with increasing temperature; there appears to be a slight increase with increased food availability.

5. Egg diameter decreases linearly with increasing temperature; food supply may have some effect. Variability of egg diameters decreases with decreasing temperature.

6. Egg mortality is highest towards the lower limit of B. symmetrica's normal thermal range and lowest near the middle.

7. Clutch size decreases with increasing temperature and decreased food. At low food levels there is increased variability in clutch size; this increase is less marked at lower temperatures. Clutch size is less variable at lower temperatures.

8. Decreasing temperature increases instar development time, particularly at $10^{o}C$.

9. Reduction in food supply extends the high end of the range of ages found in a given stage and increases the mean age of the stage. The effect is most noticeable in sexually maturing female stages at low temperatures.

10. Longevity increases with decreasing temperatures and decreased food availability.

11. It is suggested that a compensatory plateau between $15^{o}C$ and $20^{o}C$ allows Boeckella symmetrica to maintain a relatively high, constant turnover rate

during spring/summer phytoplankton blooms. At low temperatures an increased diversion of available energy into reproductive processes coupled with increased longevity and decreased development rates would act to establish a predominantly young population during the nutrient poor winter months. Such a population could obtain maximum benefit from phytoplankton blooms associated with the warmer temperatures that follow.

12. Predictions of population growth based on the vital statistics of isolated individuals are most successful in low food regimes; differences in survivorship of isolated and mass-cultured animals account for most discrepancies between observed and predicted stage dynamics.

13. In all mass cultures, appropriate modifications of the model's input data enabled the model-generated dynamics to be fitted to the observed stage dynamics.

14. These modified inputs were then successful in predicting the stage-specific population dynamics of replicate mass cultures.

15. The information generated by the population model (and provided by the modelling process itself) is, in many respects, more sophisticated than that produced by any existing stage-grouped model.